



# **Developing Shellfish Water in the Coan And Little Wicomico Rivers**

Northumberland  
County Library,  
VA



23May 2003

## *What is a TMDL?*

TMDL = Total Maximum Daily Load =  
maximum amount of a pollutant that can  
enter a waterbody without violating water  
quality standards (WQS)

WQS = numeric or narrative limits on  
pollutants that ensure the protection of  
human health and of aquatic life



## *Where do we need TMDLs?*

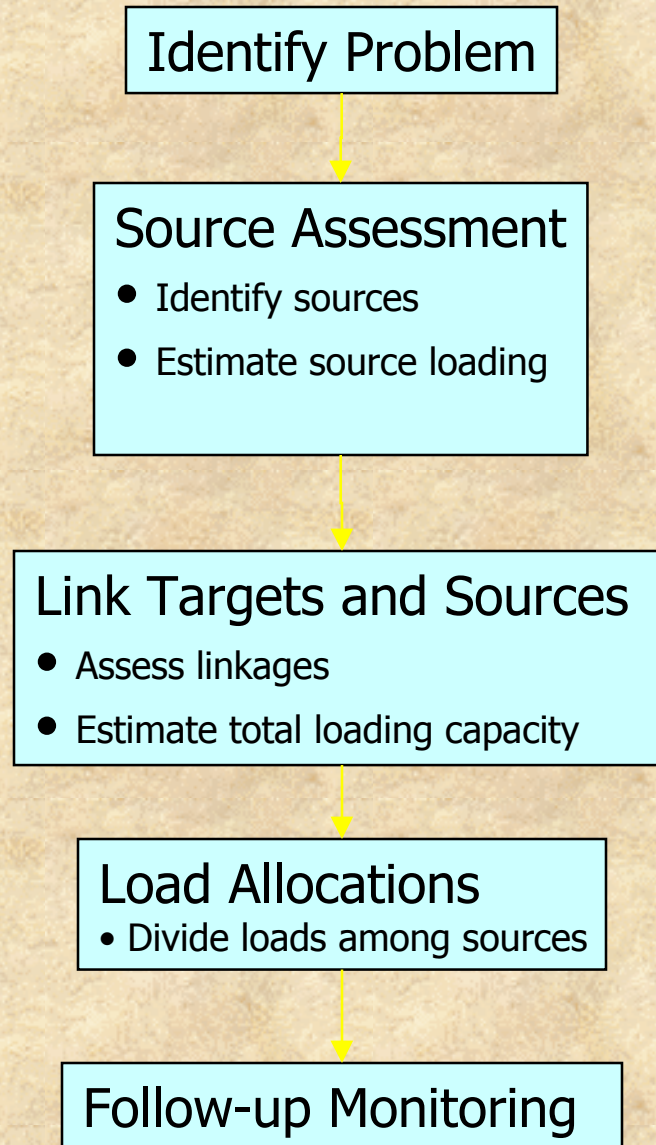
- TMDLs need to be developed for water bodies that do not meet water quality standards (impaired waters).
- Impaired waters occur throughout Virginia in lakes, streams and tidal waters.
- In Virginia, TMDLs for 644 impaired waters need to be developed by 2010. Of these, 230+ are shellfish water closures

## *Why TMDLs for the Coan and Little Wicomico R.?*

- VDH Division of Shellfish Sanitation (DSS) monitors fecal coliform levels in shellfish waters
- Applicable water quality standard: 30-month geometric mean not exceeding 14 MPN/100 mL, and a 90th percentile not exceeding 49 MPN/100 mL
- Observed exceedances necessitate TMDLs



# Components of TMDL Study



## *Required Elements of a TMDL*

- Be developed to meet water quality standards;
- Be developed for critical stream conditions;
- Consider seasonal variations;
- Include wasteload and load allocations;
- Include a margin of safety;
- Consider impacts of background contributions;
- Be subjected to public participation; and
- Have reasonable assurance for implementation.

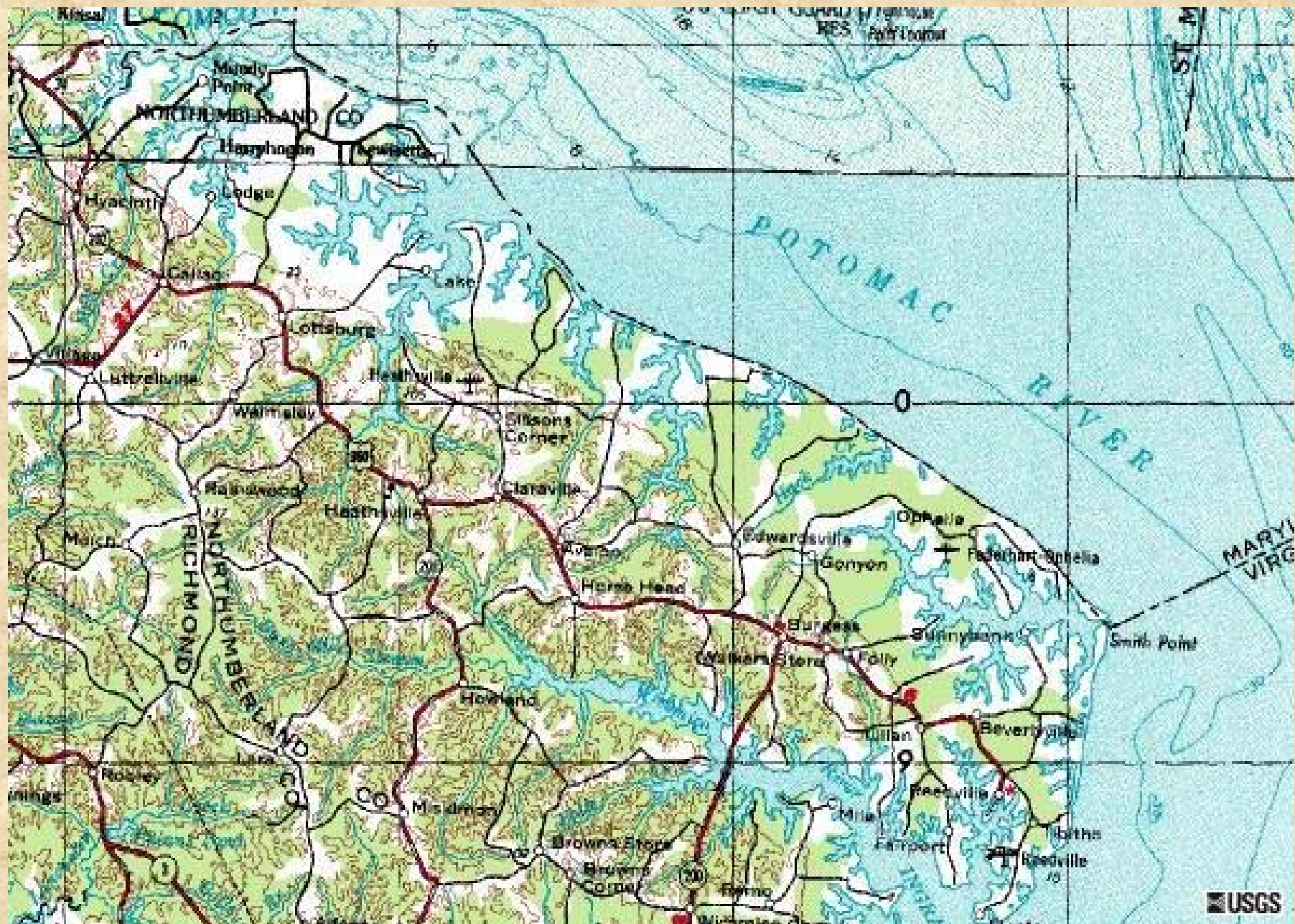


# Virginia's TMDL Development Process

- Public notice for TMDL development
- TMDL study
- Public notice for Draft TMDL
- Final TMDL report
- EPA approval
- Implementation process

==> Opportunities for public input and participation





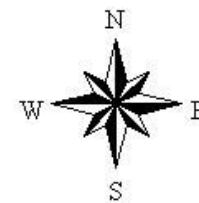


# Location Map Coan River Watershed





# Coan River Land Use

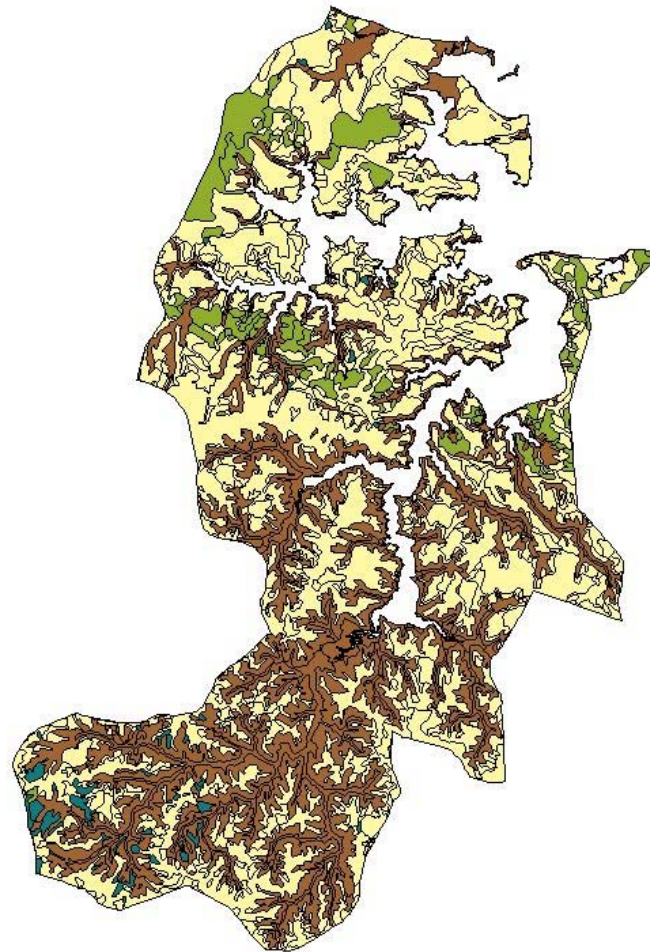




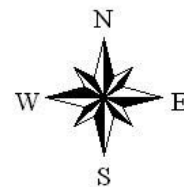
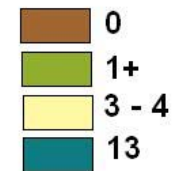
Land Use Category	Area (acres)	Area (%)
Transitional	210	1.4
Forest	7309	48.9
Wetland	581	3.8
Row Crops	2239	15.0
Pasture/Hay	3955	26.4
Commercial/Industrial/Transportation	71	0.5
Residential	143	1.0
Open Water	443	3.0
Total	14951	100

Source: Virginia National Land Cover Data (NLCD) Version 05-27-99

# Coan River Watershed Average Soil Permeability (in/hr)

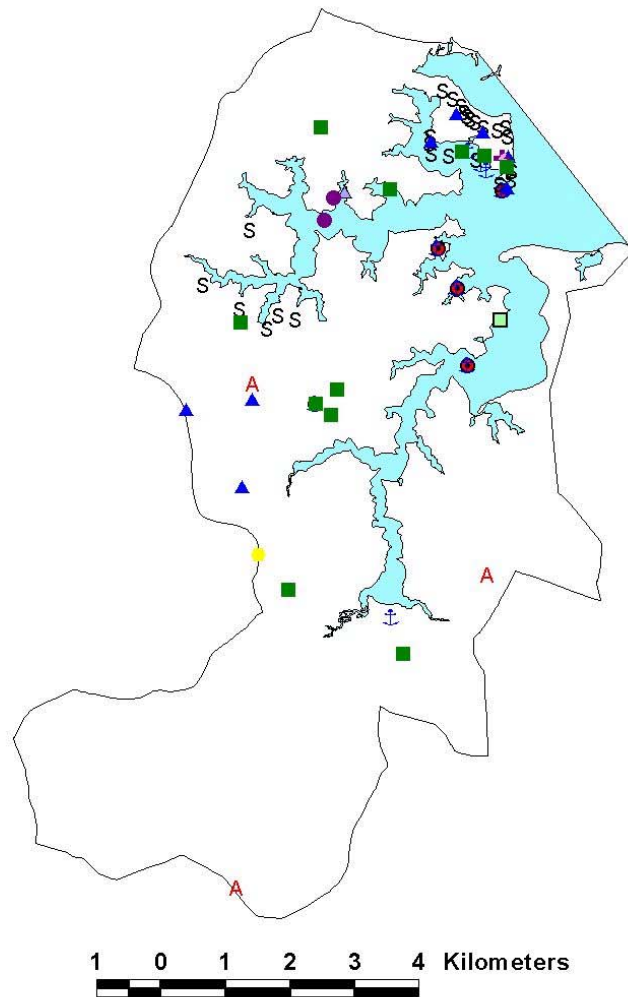


Inches/hour





# Coan River Sanitary Survey Deficiencies



## Coan River Sanitary Survey Deficiencies

- A CONTRIBUTES ANIMAL POLLUTION, indirect
- △ CONTRIBUTES POLLUTION (kitchen or laundry wastes), direct
- ▲ CONTRIBUTES POLLUTION (kitchen or laundry wastes), indirect
- CONTRIBUTES POLLUTION, direct
- CONTRIBUTES POLLUTION, indirect
- NO FACILITIES, indirect
- ⚡ POTENTIAL POLLUTION
- ✚ POTENTIAL POLLUTION, indirect
- SOLID WASTE DUMPSITE, indirect

## Coandef2

S Stormwater

## Coandef2

⚓ Boating Activity

## Coandef2

● Industrial Waste

## Coan River Boundary

□ current

■ water



Comprehensive Coastal Inventory  
Center for Coastal Resources Management  
Virginia Institute of Marine Science

**WILLIAM & MARY**  
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SCHOOL OF MARINE SCIENCE

Survey Date: 2-25-97

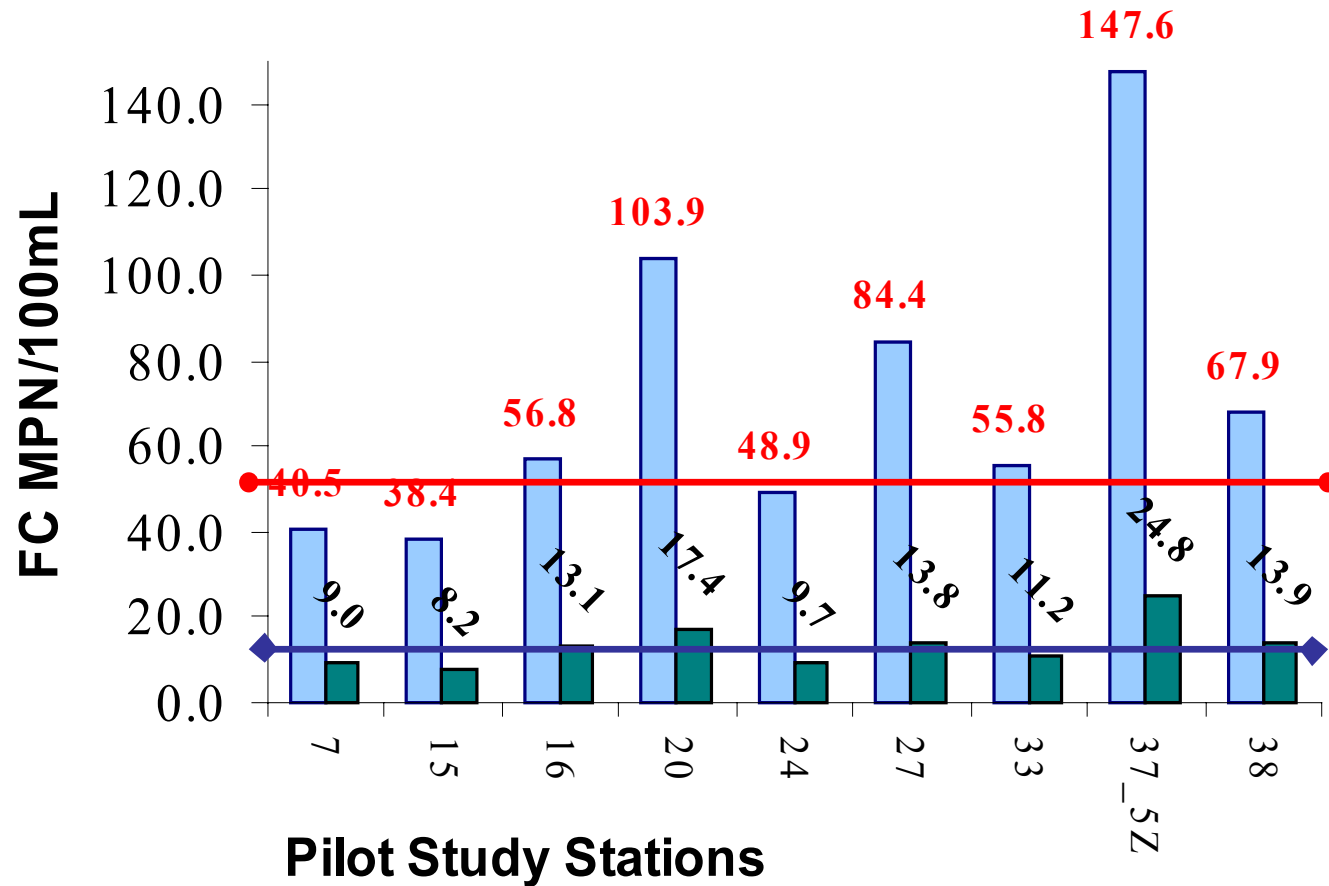
# Coan River Summary Standard Comparison

Station	90 <sup>th</sup> Percentile Preceding 30 Months	Water Quality Standard	Station Meets Standard?	Geometric Mean	Geometric Mean Standard	Station Meets Standard ?	Current Condem- nation
7 – 145A	40.5	49	Yes	9.0	14	Yes	No
15 – 145C	38.4		Yes	8.2		Yes	No
16 – 145B	56.8		Yes	13.1		Yes	No
20 – 145D*	103.9		No	17.4		No	Yes
24 – 145E*	56.8		No	9.7		Yes	Yes
27 – 145F*	84.4		No	13.8		Yes	Yes
33 – 145G*	55.8		No	11.2		Yes	Yes
37_5z – 145H*	147.6		No	24.8		No	Yes
38 – 145I*	67.9		No	13.9		Yes	Yes

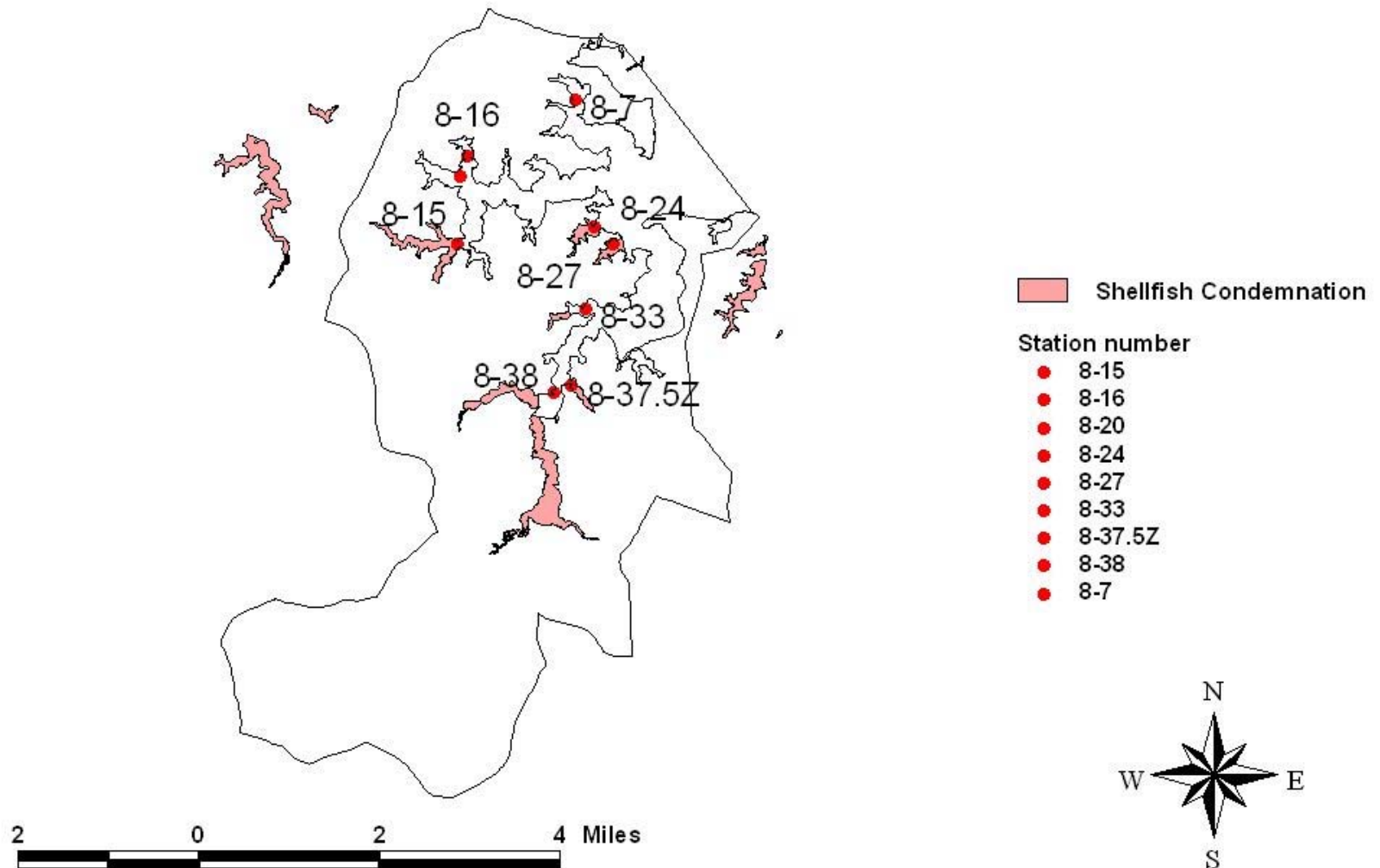
\* Red numbers represent TMDL shellfish areas closed to harvesting.



## COAN: 90th percentile and geomean for last 30 sampling events

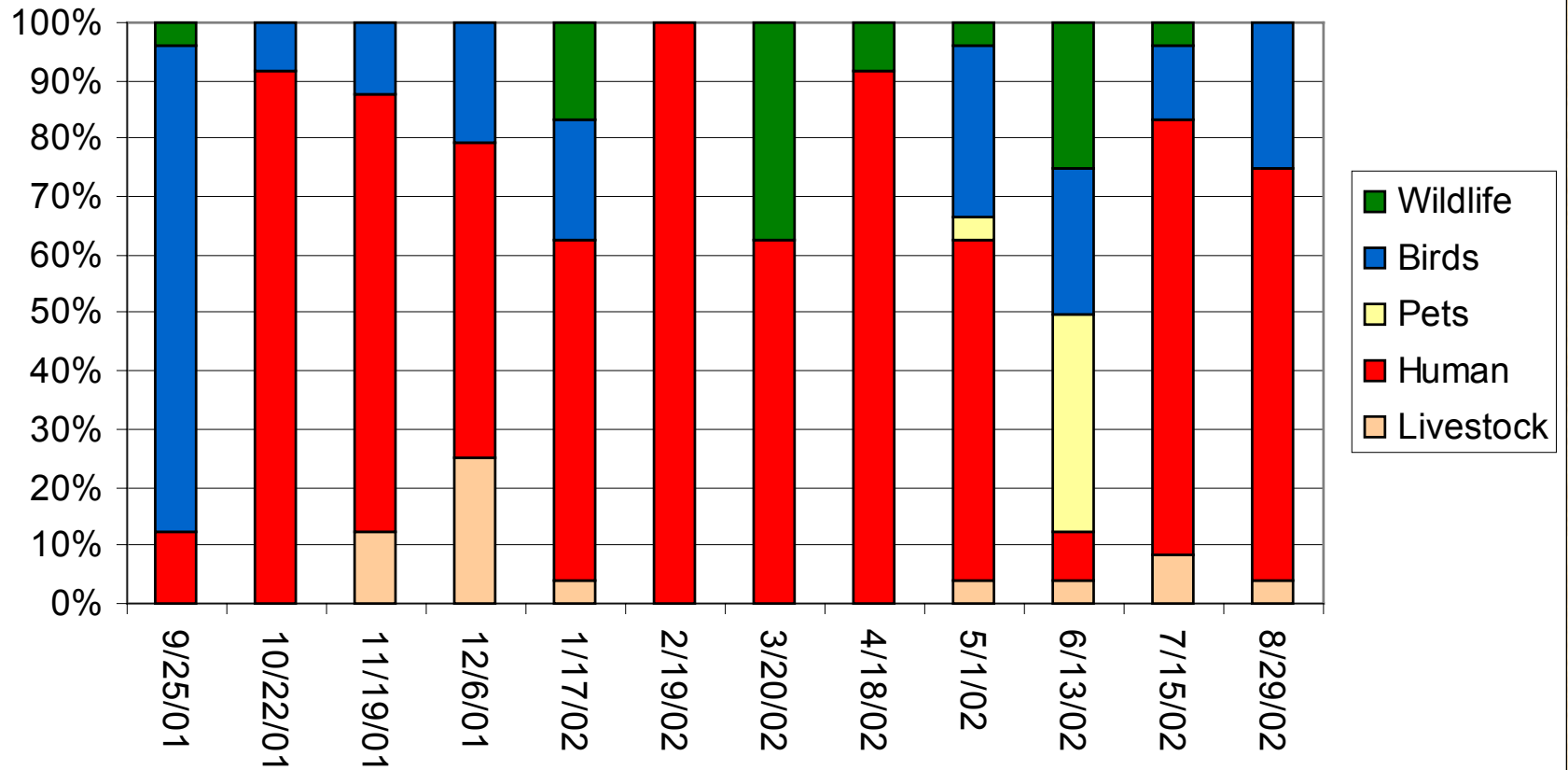


# Coan River Pilot Study Stations

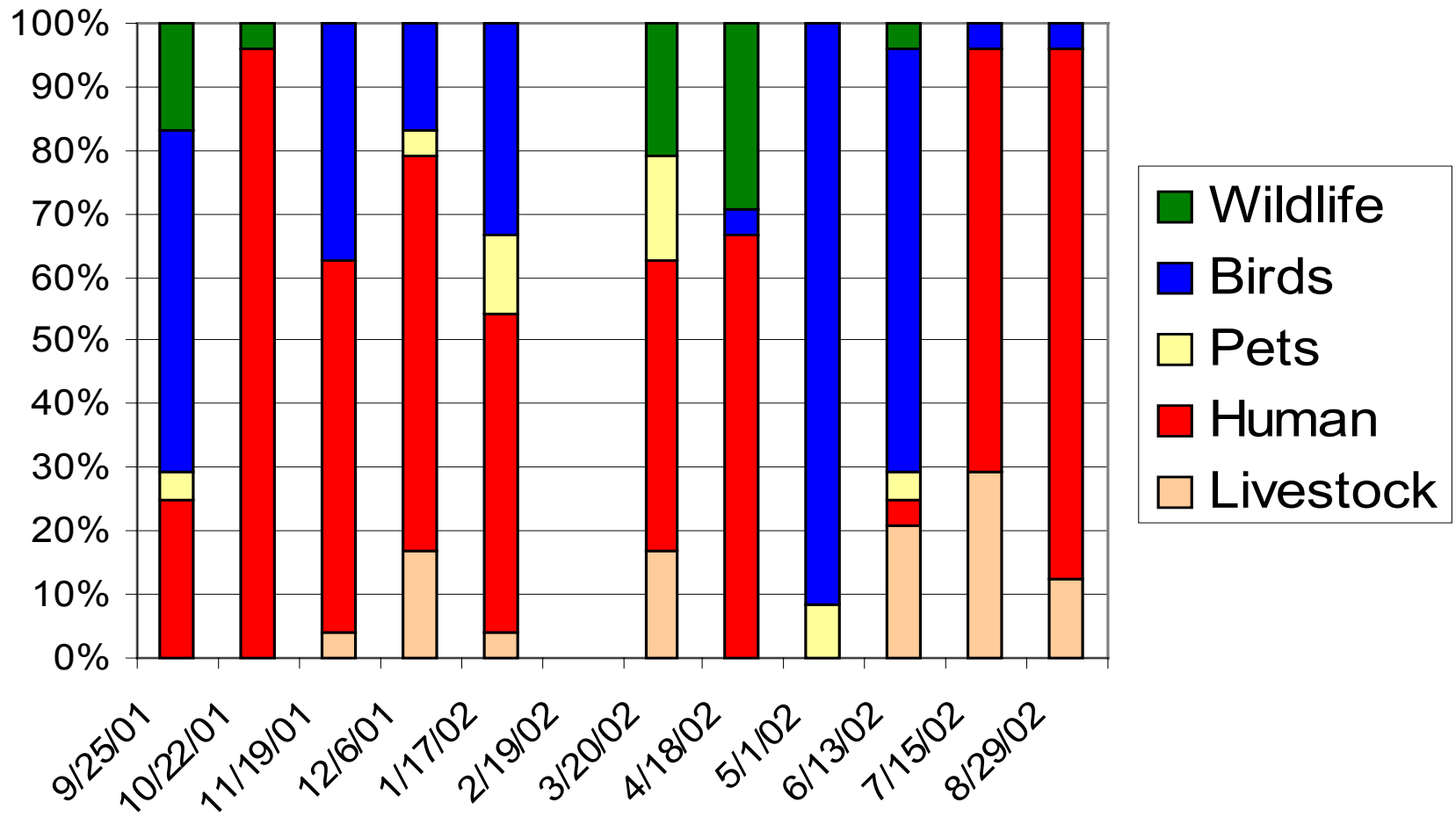




# BST Results Station 20

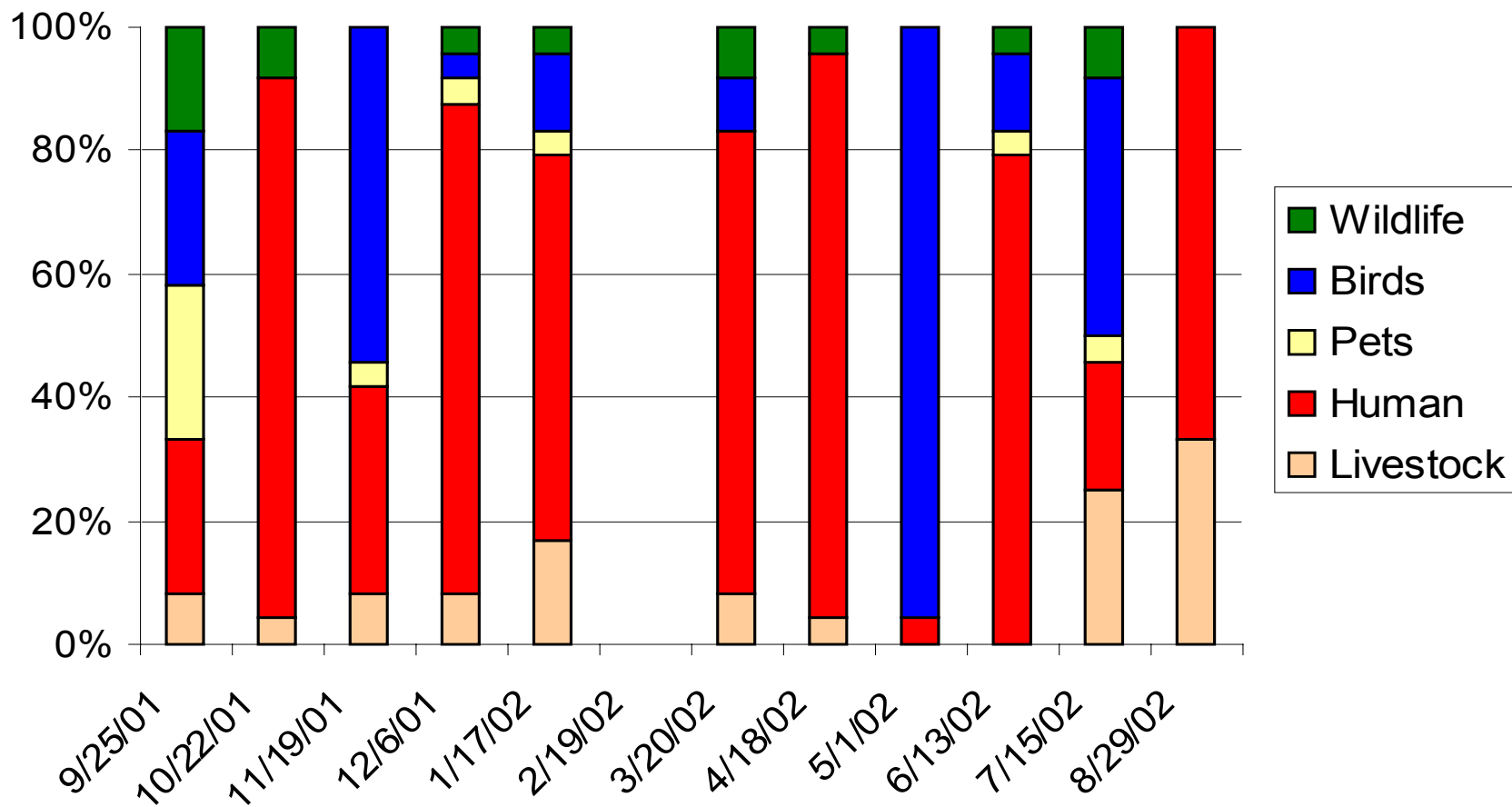


# BST Results Station 24

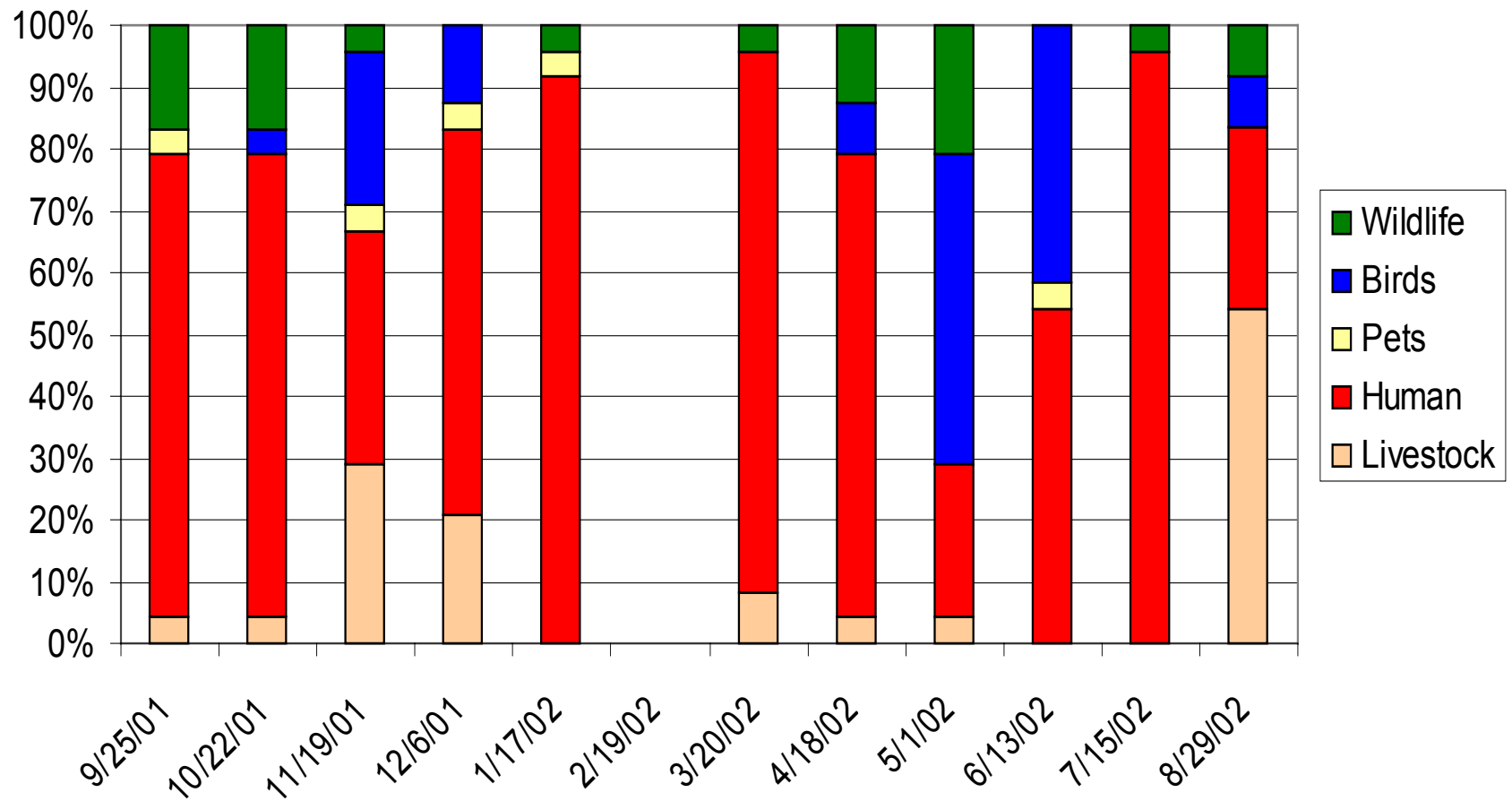




## BST Results Station 27

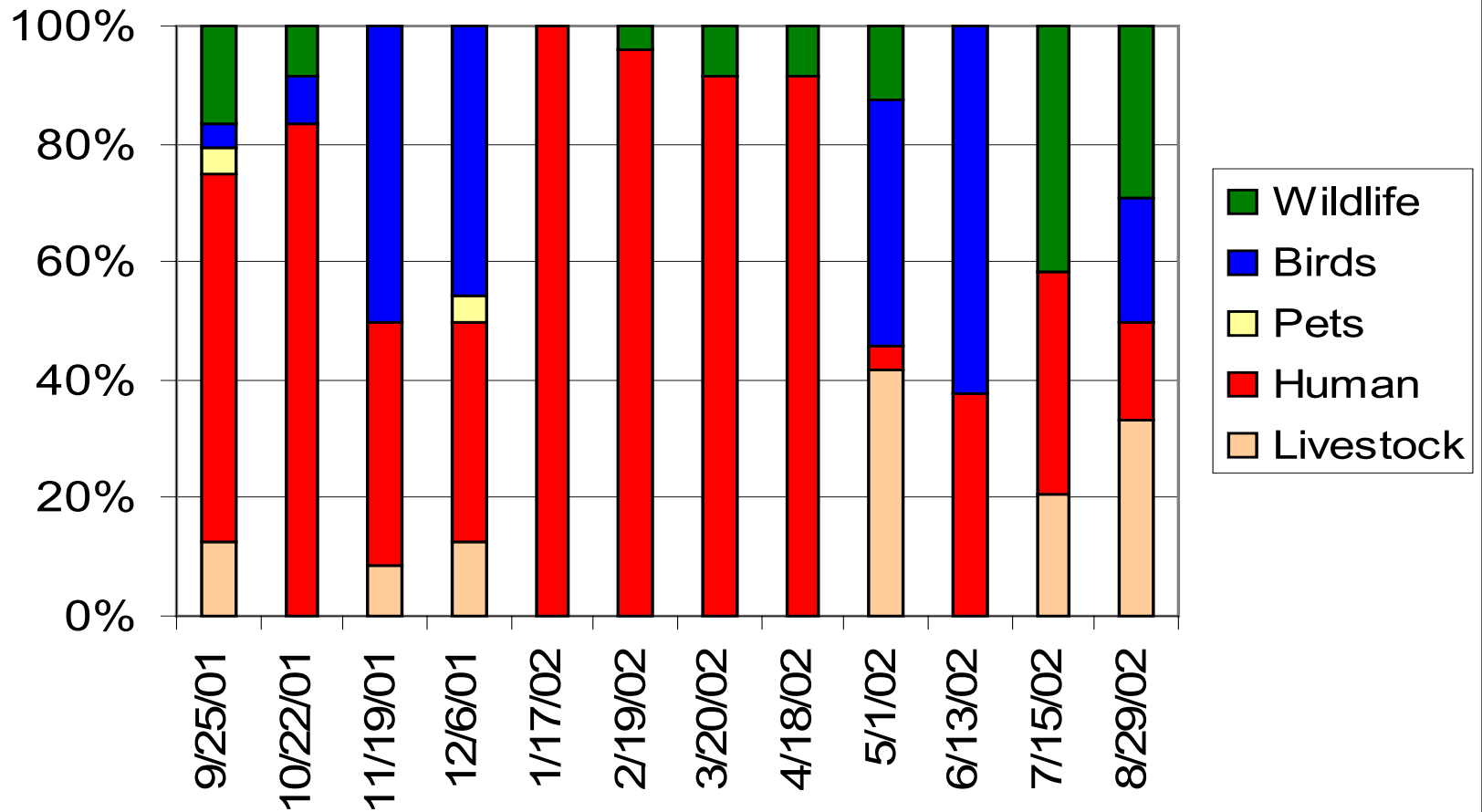


## BST Results Station 33

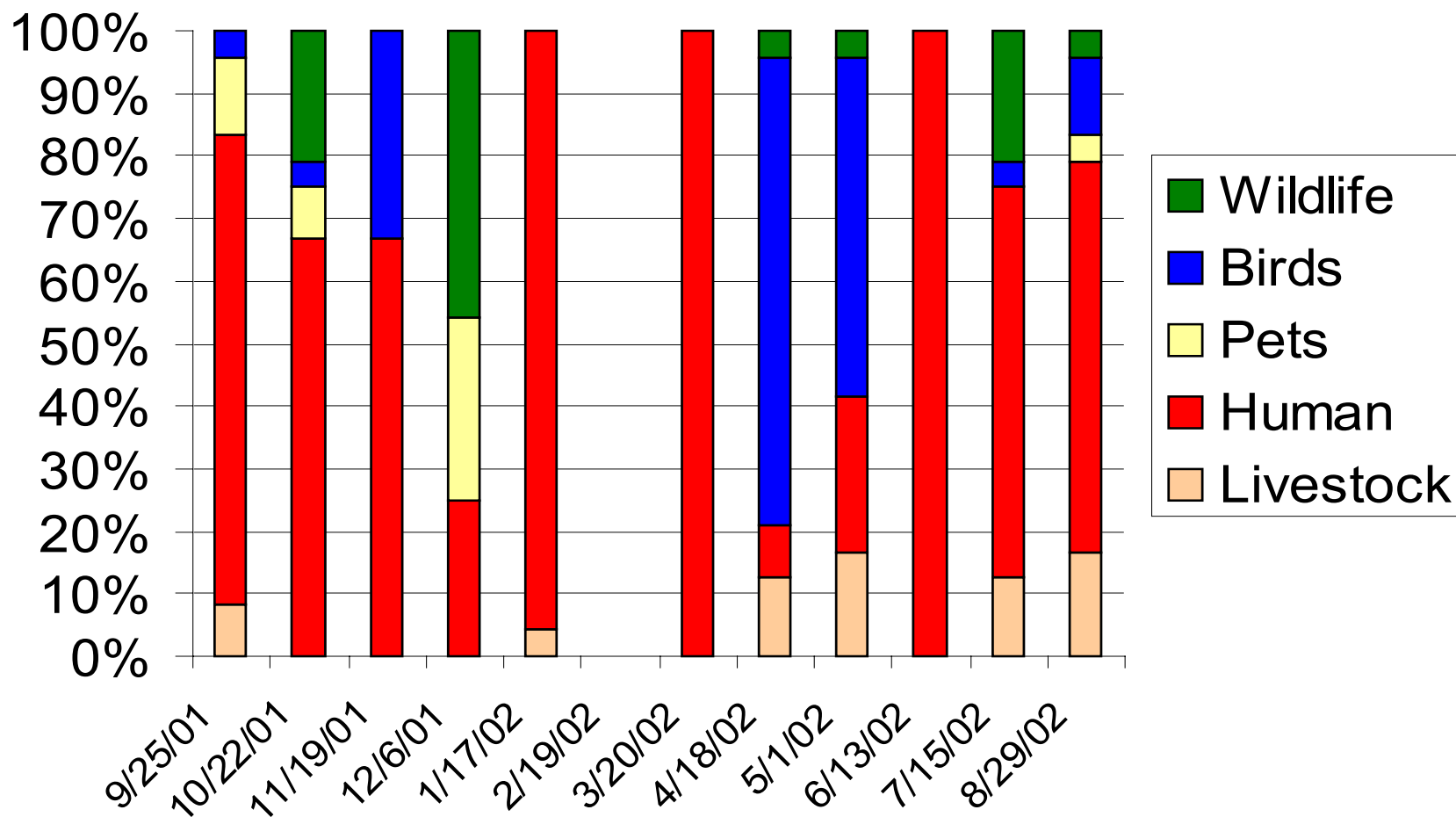




## BST Results Station 37\_5z

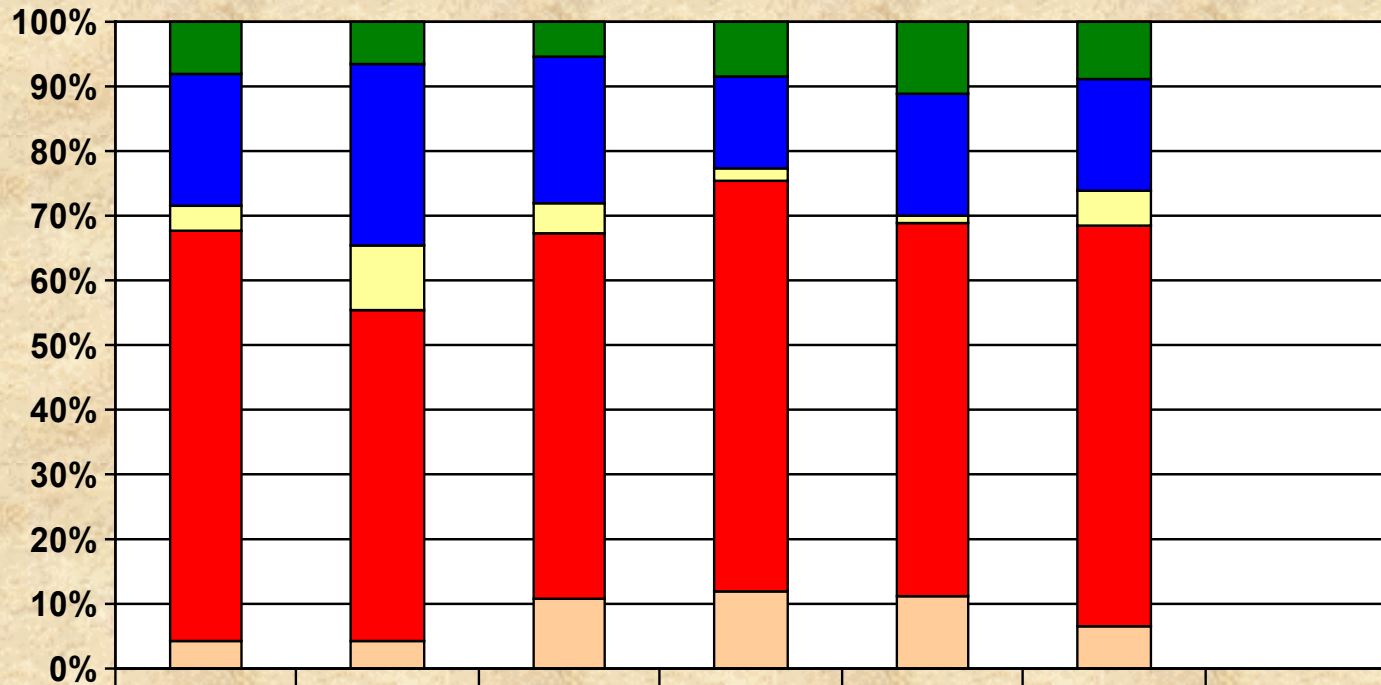


## BST Results for Station 38





## Annual Average BST Data for the Coan River



	Station 20	Station 24	Station 27	Station 33	Station 37-5z	Station 38	
Wildlife	8	6	5	8	11	8	
Bird	20	26	21	13	19	16	
Pets	4	9	4	2	1	5	
Human	63	47	52	59	58	57	
Livestock	4	4	10	11	11	6	

## Calculation Results Geometric Mean

<b>CLOSURE ID AND STATION NUMBER</b>	<b>GEO –METRIC MEAN</b>	<b>SEGMENT VOLUME (CUBIC METERS)</b>	<b>VOLUME X GEO - MEAN</b>	<b>VOLUME X CRITERIA (14MPN/100ML)</b>	<b>REQUIRED REDUCTION IN PERCENT</b>
<b>145 – D STATION 20</b>	<b>17.36</b>	<b>267,565</b>	<b>4.64E+11</b>	<b>3.75E+11</b>	<b>0.2%</b>
<b>145 – E STATION 24</b>	<b>9.72</b>	<b>122,851</b>	<b>6.01E+10</b>	<b>6.02E+10</b>	<b>0%</b>
<b>145 – F STATION 27</b>	<b>13.76</b>	<b>117,284</b>	<b>1.61E+10</b>	<b>5.75E+10</b>	<b>0%</b>
<b>145 – G STATION 33</b>	<b>11.24</b>	<b>39,615</b>	<b>4.45E+09</b>	<b>1.94E+10</b>	<b>0%</b>
<b>145 – H STATION 37_5Z</b>	<b>24.83</b>	<b>43,076</b>	<b>1.07E+10</b>	<b>2.11E+10</b>	<b>0%</b>
<b>145 – I STATION 38</b>	<b>13.86</b>	<b>1,112,690</b>	<b>1.54E+11</b>	<b>1.56E+10</b>	<b>0%</b>



## Calculation Result 90th Percentile Criterion

<b>CLOSURE ID AND STATION NUMBER</b>	<b>90<sup>TH</sup> PERCENT. VALUE (MPN/100ML)</b>	<b>SEGMENT VOLUME (CUBIC METERS)</b>	<b>VOLUME X 90<sup>TH</sup> PERCENT. VALUE = ACTUAL LOAD</b>	<b>VOLUME X 90<sup>TH</sup> CRITERIA (49MPN/100ML ) = LOAD ALLOCATION</b>	<b>REQUIRED LOAD REDUCTION IN PERCENT</b>
<b>145 – D STATION 20</b>	103.9	267,565	2.78E+11	1.31E+11	52.84%
<b>145 – E STATION 24</b>	48.9	122,851	6.01E+10	6.02E+10	N/A
<b>145 – F STATION 27</b>	84.4	117,284	9.90E+10	5.75E+10	41.94%
<b>145 – G STATION 33</b>	55.8	39,615	2.21E+10	1.94E+10	12.19%
<b>145 – H STATION 37_5Z</b>	147.6	43,076	6.36E+10	2.11E+10	66.80%
<b>145 – I STATION 38</b>	67.9	1,112,690	7.56E+11	5.45E+11	27.84%

# *Coan River Calculation*

- Shellfish standards
  - Geometric mean = 14 mpn/100 mL
  - 90th percentile = 49 mpn/100 mL
- Maximum 30-month fecal coliform levels (90th percentile)
  - 67.9 mpn/100 mL at station 38
- Total Organisms = concentration x volume (station 38)
- Total Organisms = ( 679,000 mpn/m<sup>3</sup>) (1,112,690 m<sup>3</sup>)
- Total Organisms = 7.56E+11
- Allowable organisms at 49 mpn/100 mL = 5.45E+11
- Required reduction = 27.8%



# Coan River Station 38 Data

DATE	BACTERIA MPN/100ML	WILDLIFE	HUMAN	LIVESTOCK	PETS	BIRDS
9/25/01	23	4.17	75	8.33	12.5	0
10/22/01	9.1	4.17	66.67	0	8.33	20.83
11/19/01	93	33.33	66.67	0	0	0
12/6/01	23	0	25	0	29.17	45.83
1/17/02	3.6	0	95.83	4.17	0	0
2/19/02	2.9	0	0	0	0	0
3/20/02	43	0	100	0	0	0
4/18/02	240	75	8.33	12.5	0	4.17
5/1/02	43	54.17	25	16.67	0	4.17
6/13/02	3.6	0	100	0	0	0
7/15/02	9.1	4.17	62.5	12.5	0	20.83
8/29/02	23	12.5	62.5	16.67	4.17	4.17
Average		16	57	6	5	8

# *TMDL Calculation Station 38*

<b>Total = 100%</b>	7.56E+11		5.45E+11		28%
<b>Wildlife = 8%</b>	6.05E+10		6.05E+10		0%
<b>Bird = 16%</b>	1.21E+11		1.21E+11		0%
<b>Human = 57%</b>	4.31E+11		2.80E+11		35%
<b>Pets = 5%</b>	3.78E+10		3.78E+10		0%
<b>Livestock = 6%</b>	4.54E+10		4.54E+10		0%

Assumptions: 30-month analysis represents typical state for waterbody, TMDL developed for critical condition is protective of WQ under typical hydrologic conditions.

TMDL uses conservative assumptions by applying highest concentration only.

Recommendations: Maximize human reductions.

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# Bacterial TMDL for the Coan River Stations 20 and 24

<b>AREA 145-D STATION 20</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>2.78E+11</b>	<b>1.31E+11</b>	<b>53%</b>
<b>Bird</b>	<b>20%</b>	<b>5.90E+10</b>	<b>5.90E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>8%</b>	<b>2.36E+10</b>	<b>2.36E+10</b>	<b>0%</b>
<b>Human</b>	<b>63%</b>	<b>1.86E+11</b>	<b>5.76E+10</b>	<b>69%</b>
<b>Pets</b>	<b>4%</b>	<b>1.18E+10</b>	<b>1.18E+10</b>	<b>0%</b>
<b>Livestock</b>	<b>4%</b>	<b>1.18E+10</b>	<b>1.18E+10</b>	<b>0%</b>

<b>AREA 145-E STATION 24</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>6.01E+10</b>	<b>6.02E+10</b>	<b>0%</b>
<b>Bird</b>	<b>26%</b>	<b>1.56E+10</b>	<b>1.56E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>6%</b>	<b>3.61E+09</b>	<b>3.61E+09</b>	<b>0%</b>
<b>Human</b>	<b>47%</b>	<b>2.82E+10</b>	<b>2.82E+10</b>	<b>0%</b>
<b>Pets</b>	<b>9%</b>	<b>5.41E+09</b>	<b>5.41E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>4%</b>	<b>2.40E+09</b>	<b>2.40E+09</b>	<b>0%</b>

## Bacterial TMDL for the Coan River Stations 27 and 33

<b>AREA 145-F STATION 27</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>9.90E+10</b>	<b>5.75E+10</b>	<b>42%</b>
<b>Bird</b>	<b>21%</b>	<b>2.08E+10</b>	<b>2.08E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>5%</b>	<b>4.95E+09</b>	<b>4.95E+09</b>	<b>0%</b>
<b>Human</b>	<b>52%</b>	<b>5.15E+10</b>	<b>1.79E+10</b>	<b>65%</b>
<b>Pets</b>	<b>4%</b>	<b>3.96E+09</b>	<b>3.96E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>10%</b>	<b>9.90E+09</b>	<b>9.90E+09</b>	<b>0%</b>

<b>AREA 145-G STATION 33</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>2.21E+09</b>	<b>1.94E+09</b>	<b>12%</b>
<b>Bird</b>	<b>13%</b>	<b>2.87E+08</b>	<b>2.87E+08</b>	<b>0%</b>
<b>Wildlife</b>	<b>8%</b>	<b>1.77E+08</b>	<b>1.77E+08</b>	<b>0%</b>
<b>Human</b>	<b>59%</b>	<b>1.30E+09</b>	<b>1.19E+09</b>	<b>9%</b>
<b>Pets</b>	<b>2%</b>	<b>4.42E+07</b>	<b>4.42E+07</b>	<b>0%</b>
<b>Livestock</b>	<b>11%</b>	<b>2.43E+08</b>	<b>2.43E+08</b>	<b>0%</b>



## BST Load Results for Stations 37\_5z and 38, Coan River

<b>AREA 145-H STATION 37_5Z</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
Total	100%	6.36E+10	2.11E+10	67%
Bird	19%	1.21E+10	1.21E+10	0%
Wildlife	11%	7.00E+09	7.00E+09	0%
Human	58%	3.69E+10	3.69E+07	100%
Pets	1%	6.36E+08	6.36E+08	0%
Livestock	11%	7.00E+09	1.33E+09	81%

<b>AREA 145-I STATION 38</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
Total	100%	7.56E+11	5.45E+11	28%
Bird	16%	1.21E+11	1.21E+11	0%
Wildlife	8%	6.05E+10	6.05E+10	0%
Human	57%	4.31E+11	2.81E+11	35%
Pets	5%	3.78E+10	3.78E+10	0%
Livestock	6%	4.54E+10	4.54E+10	0%



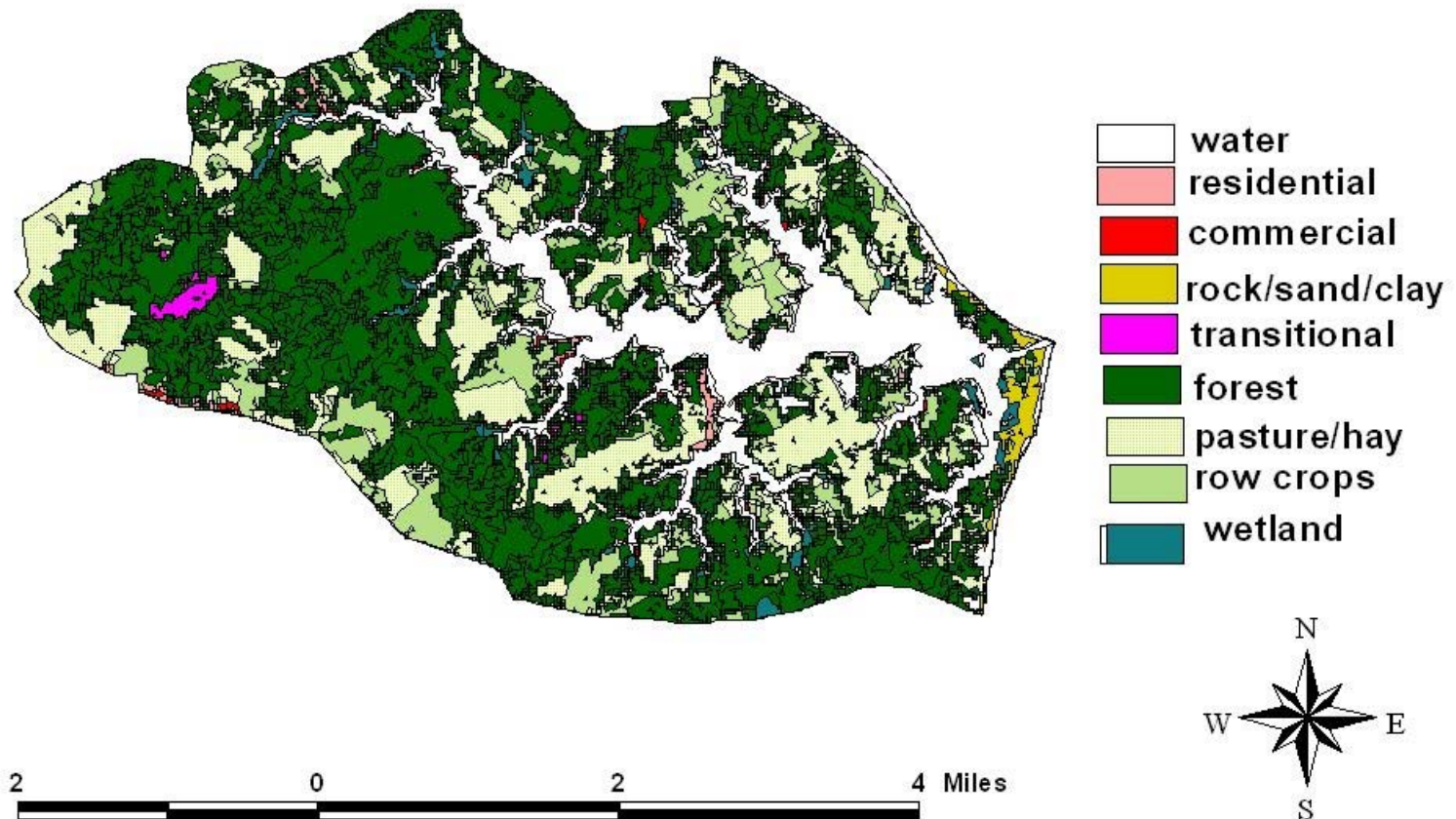
# **Little Wicomico River Watershed Results**

## Location map Little Wicomico River





# Little Wicomico River Land use



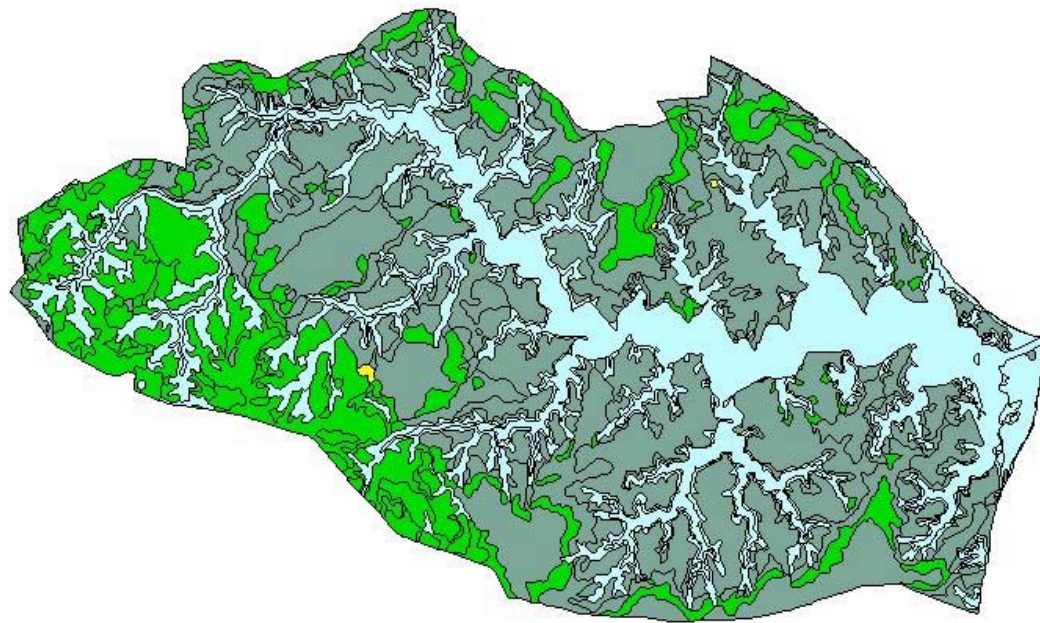


## Land Use Statistics Little Wicomico River Watershed

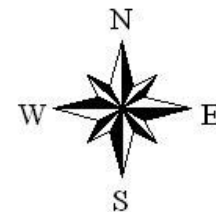
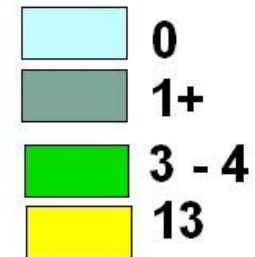
Land Use Category	Area (acres)	Area (%)
Transitional	10	>1
Forest	805	63
Wetland	96	8
Bare sand/rock/clay	12	1
Row Crops	195	15
Pasture/Hay	77	6
Commercial/Industrial/Transportation	57	4
Residential	14	1
Open Water	15	1
Total	1281	100

Source: Virginia National Land Cover Data (NLCD) Version 05-27-99

# Average Soil Permeability Little Wicomico River

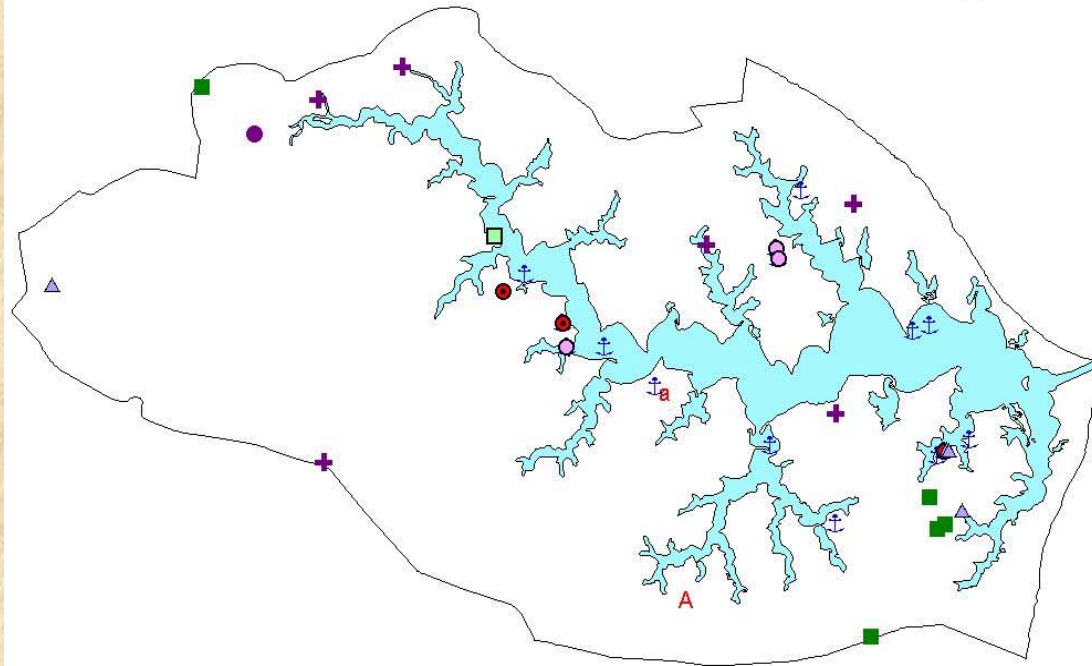


Inches/hour





# Little Wicomico River Sanitary Survey Deficiencies



## Little Wicomico River Sanitary Survey Deficiencies

- a CONTRIBUTES ANIMAL POLLUTION, direct
- A CONTRIBUTES ANIMAL POLLUTION, indirect
- △ CONTRIBUTES POLLUTION (kitchen or laundry wastes), indirect
- CONTRIBUTES POLLUTION, direct
- CONTRIBUTES POLLUTION, indirect
- NO FACILITIES, direct
- NO FACILITIES, indirect

## Wicodef2

- ▲ CONTRIBUTES POLLUTION (kitchen or laundry wastes), indirect

## Wicodef2

- + yes

## Wicodef2

- Industrial Waste

## Wicodef2

- ⚓ Boating Activity

## Little Wicomico River Boundary

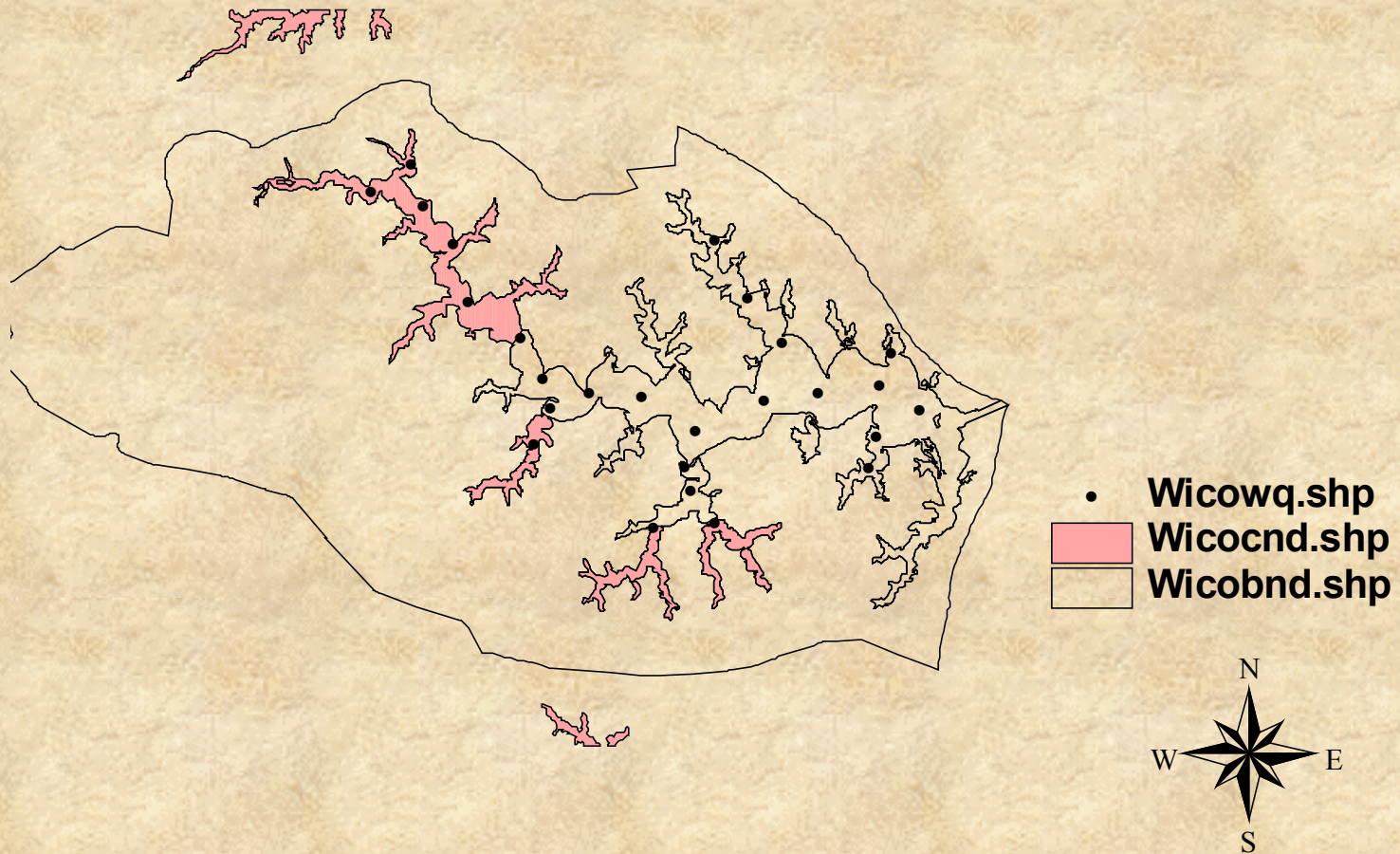
- current
- water



1 0 1 2 3 4 Kilometers

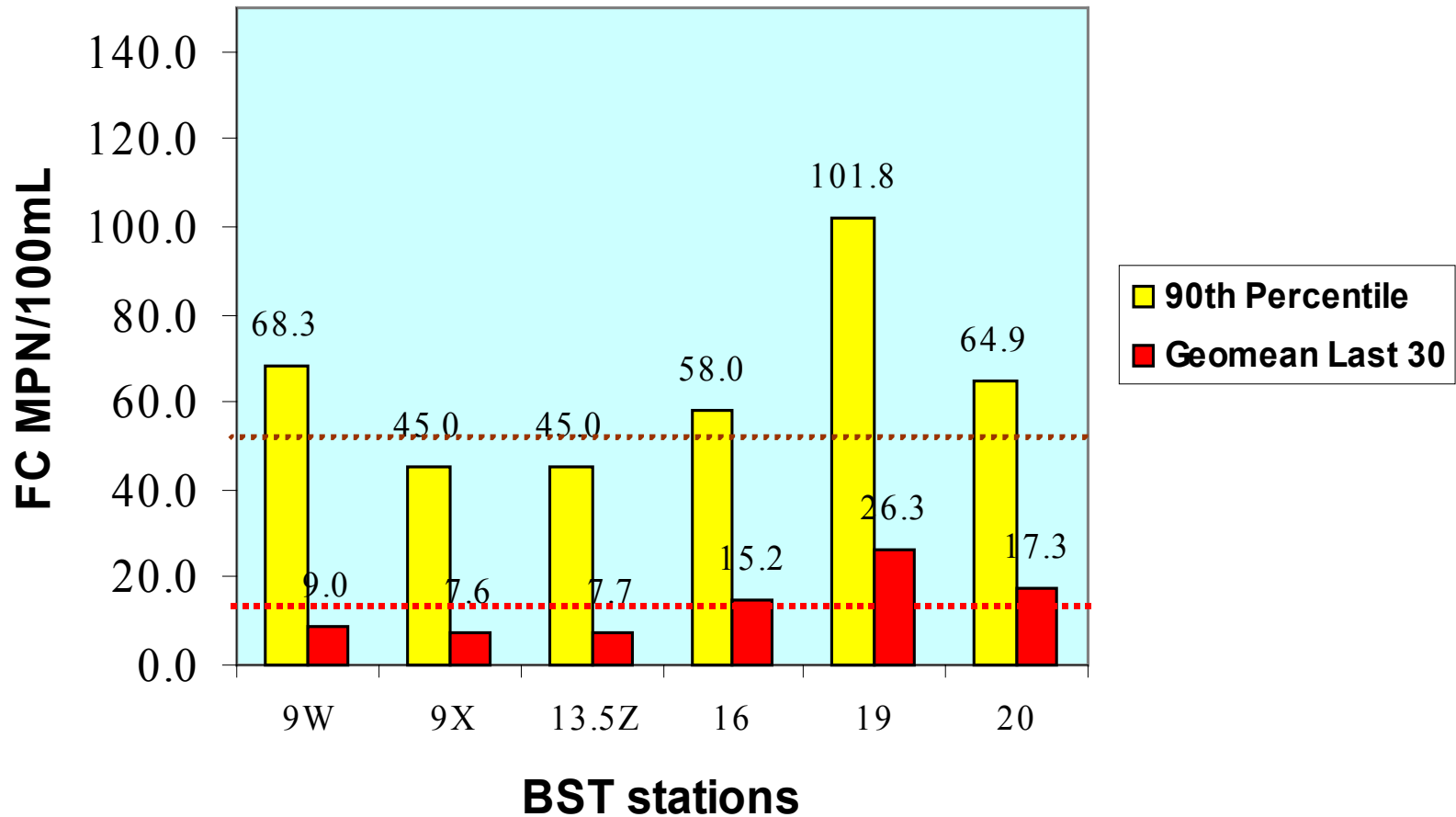
Survey Date: 10-30-00

# Little Wicomico River Water Quality Monitoring Stations

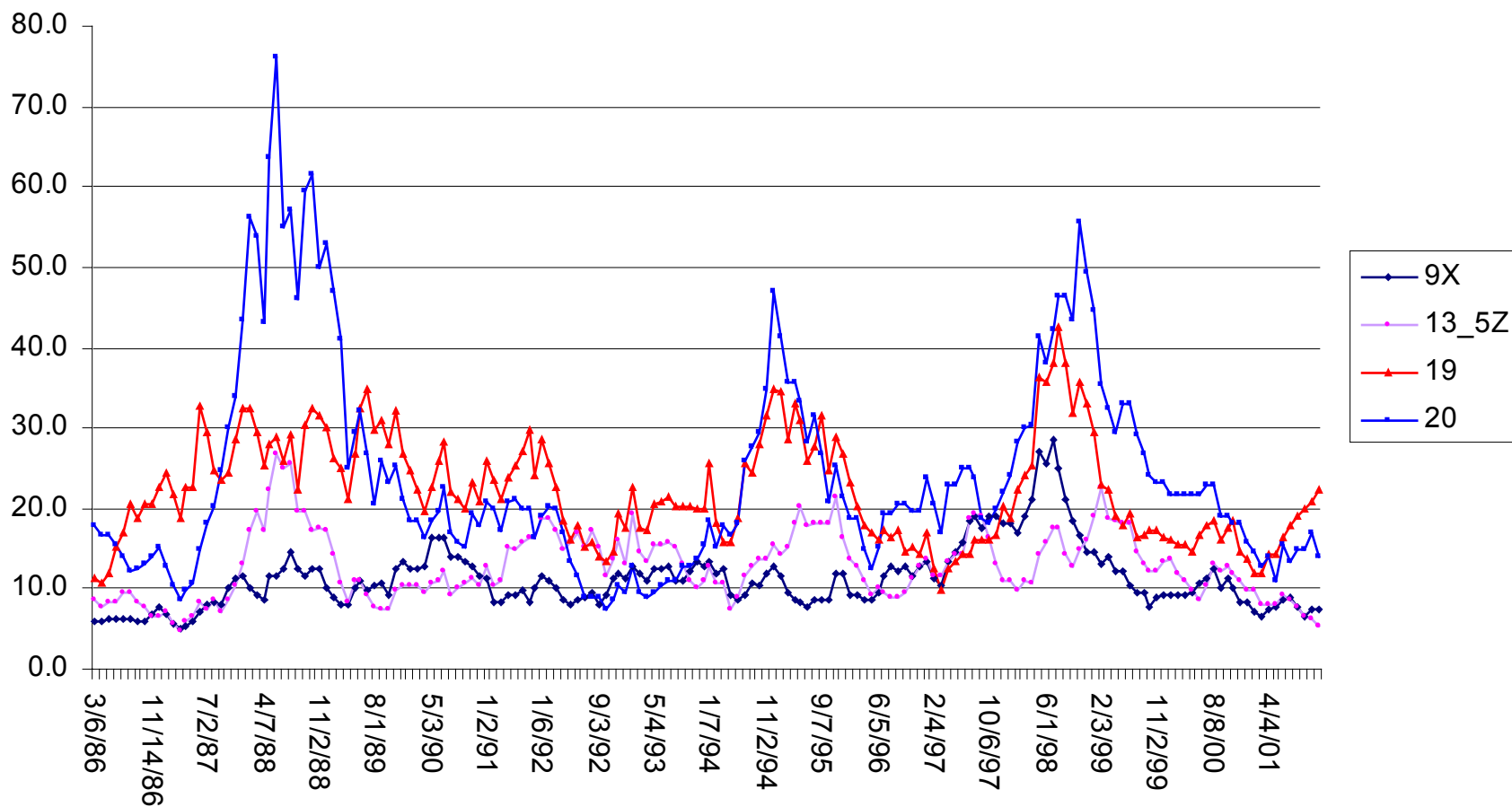




## Little Wicomico: 90th percentile and geomean for last 30 sampling events

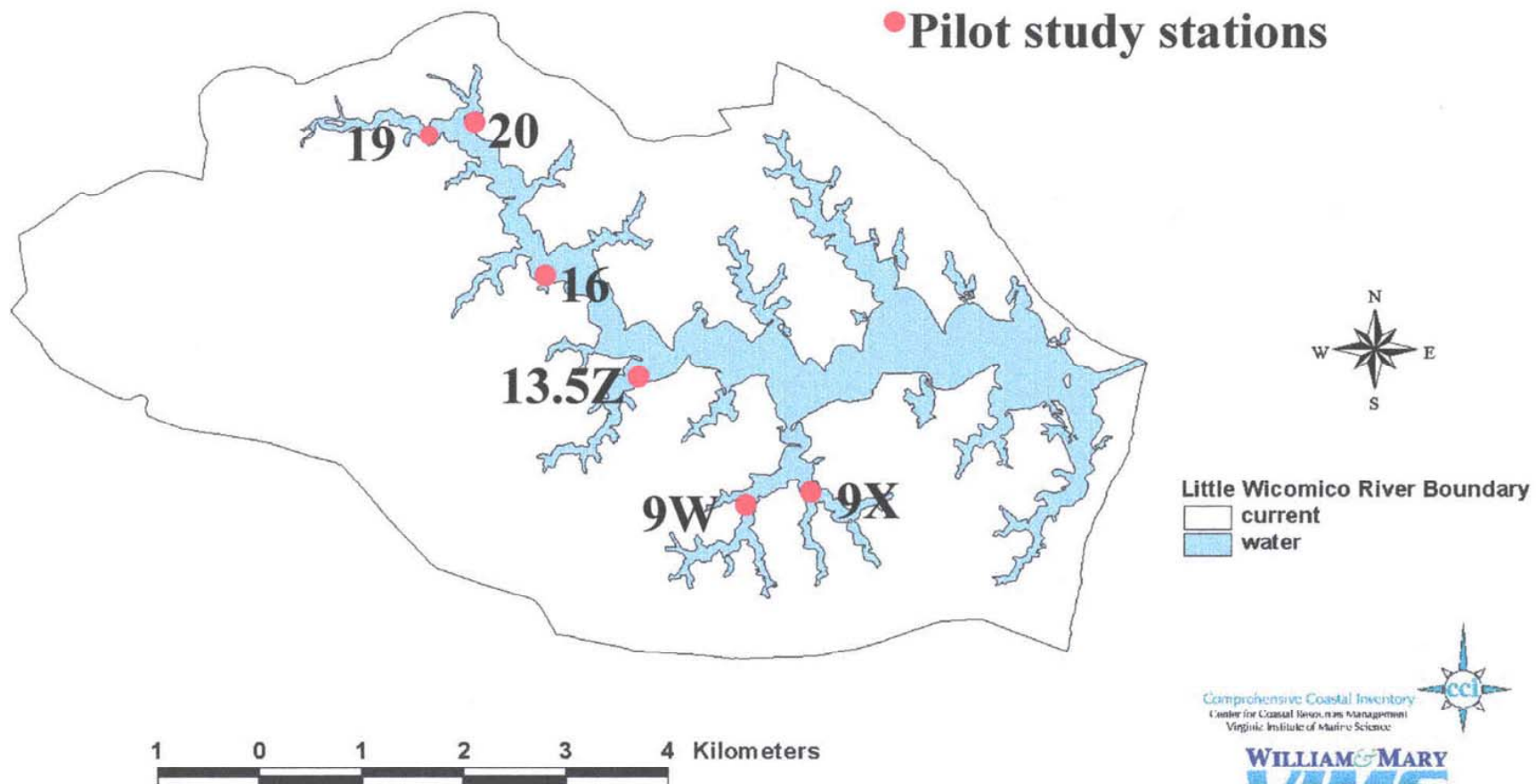


# Little Wicomico River Moving Geometric Mean

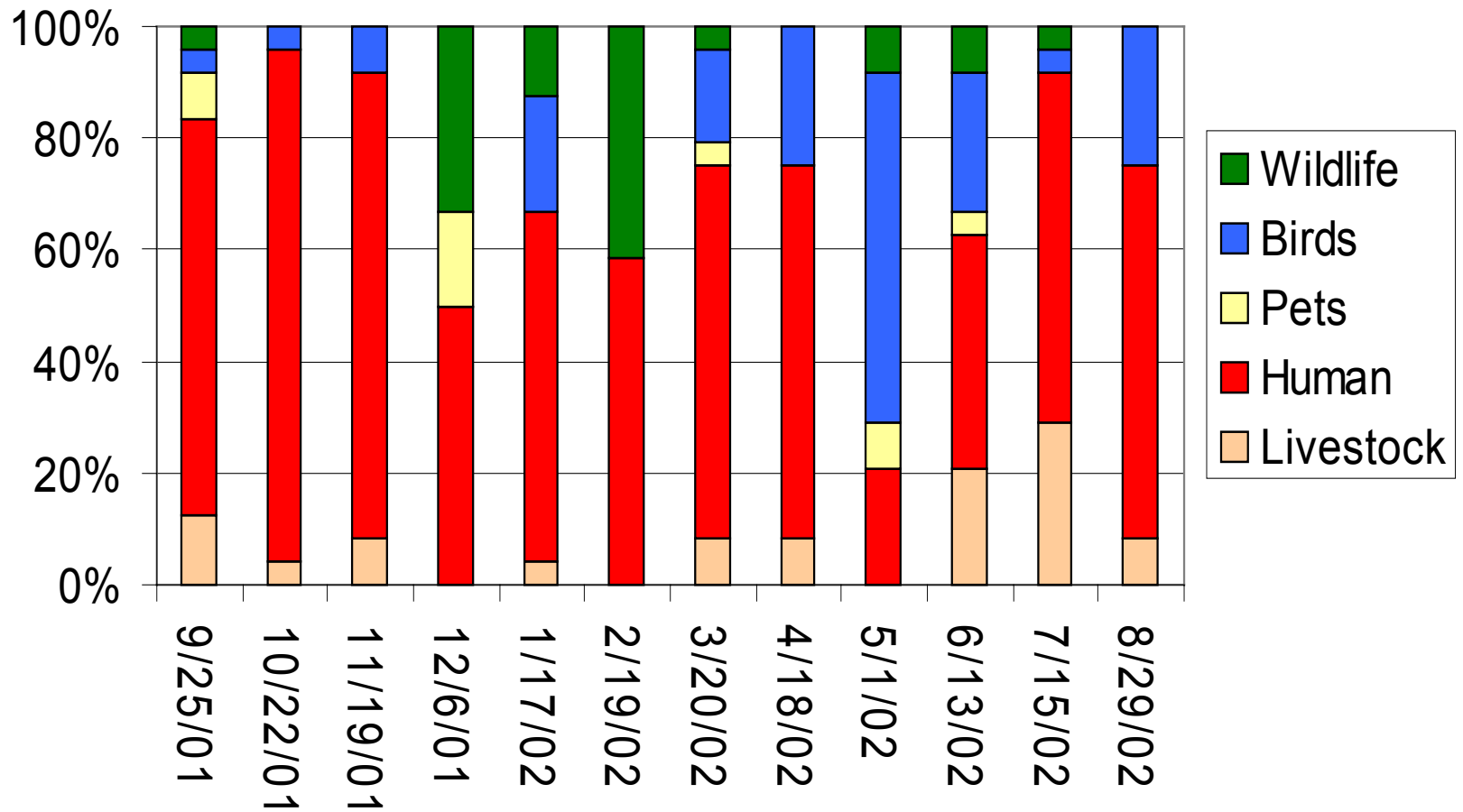




# Little Wicomico River Boundary

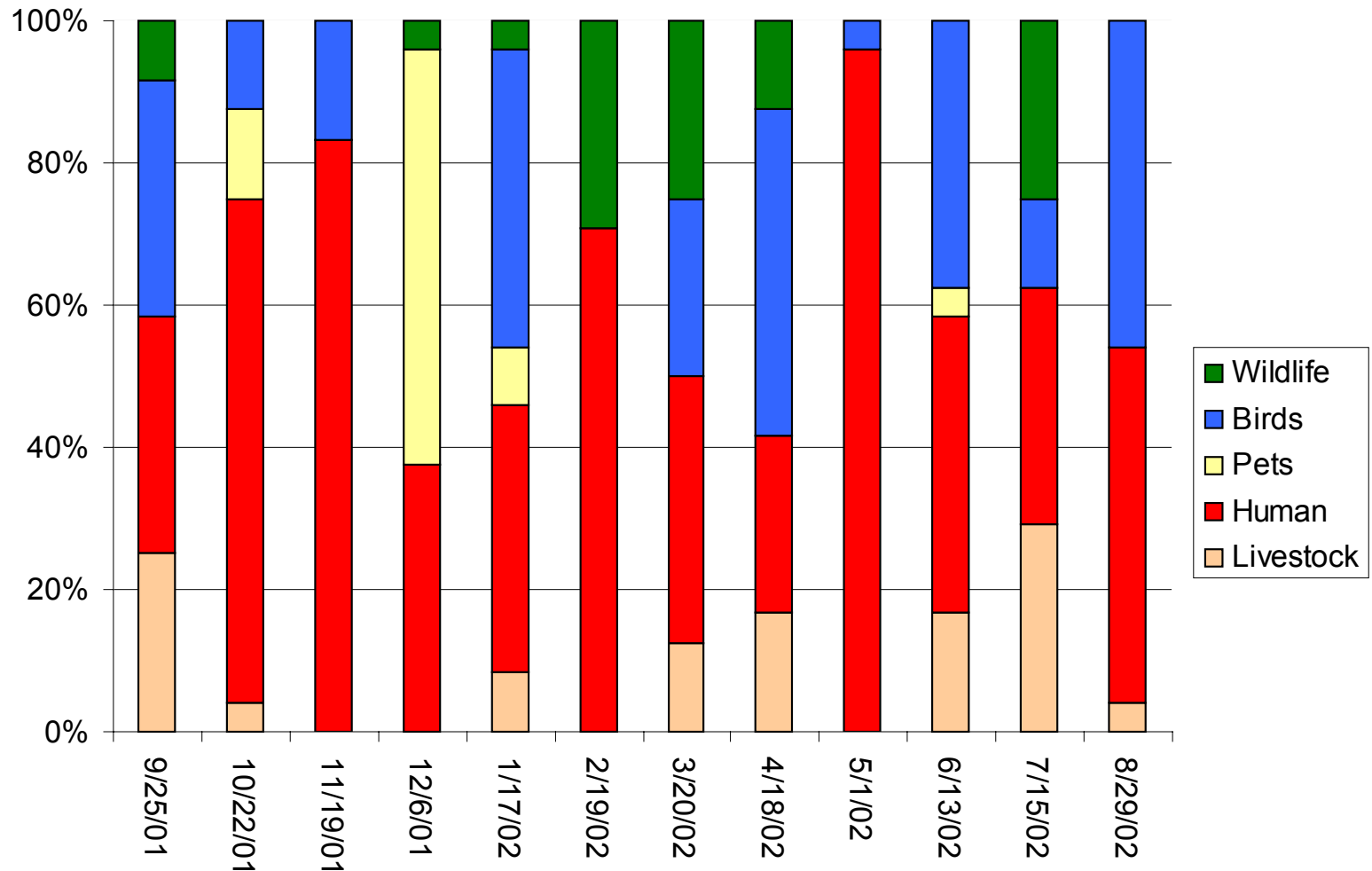


## Little Wicomico River Station 9x

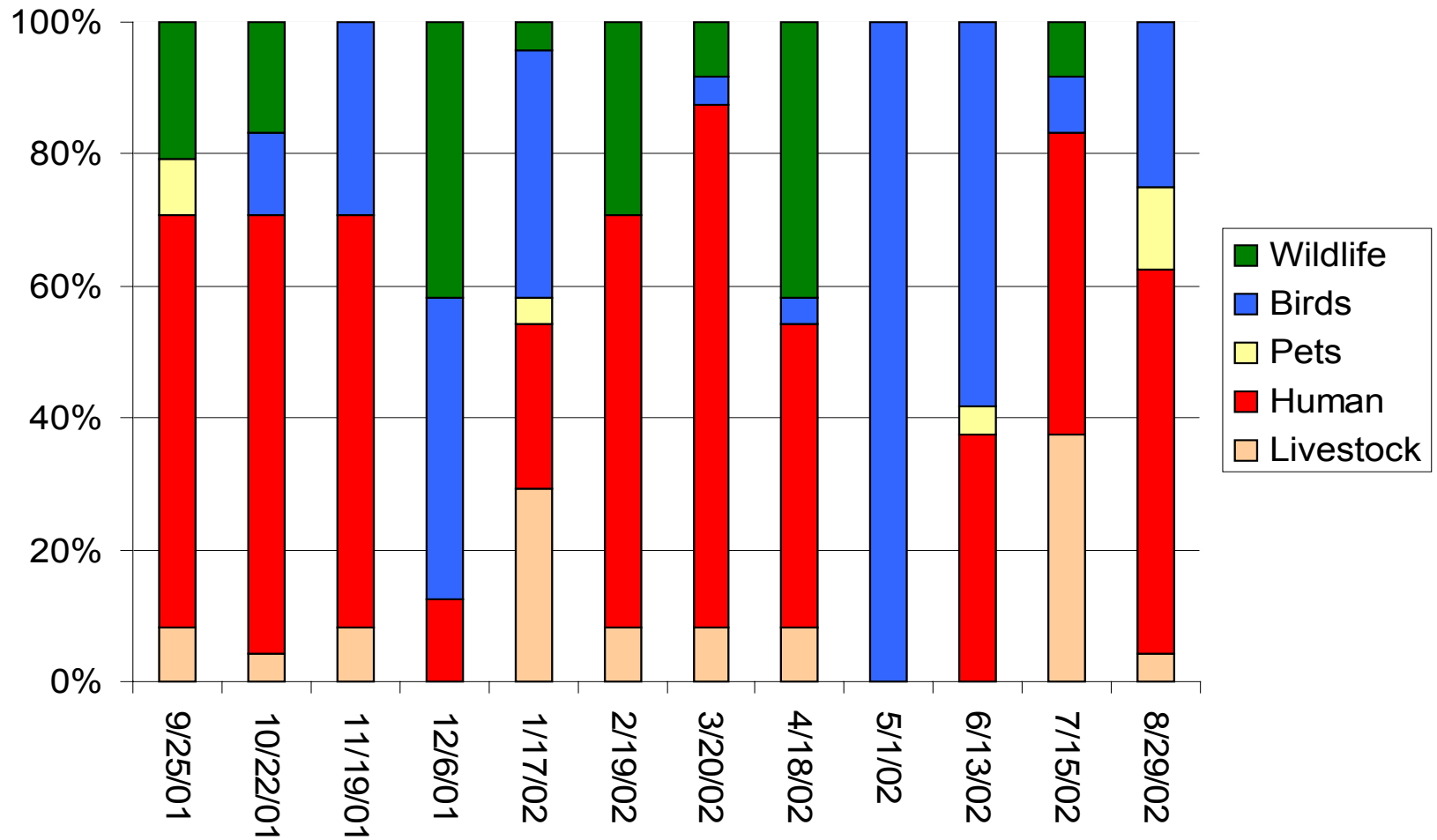




## Little Wicominco River Station 13.5Z

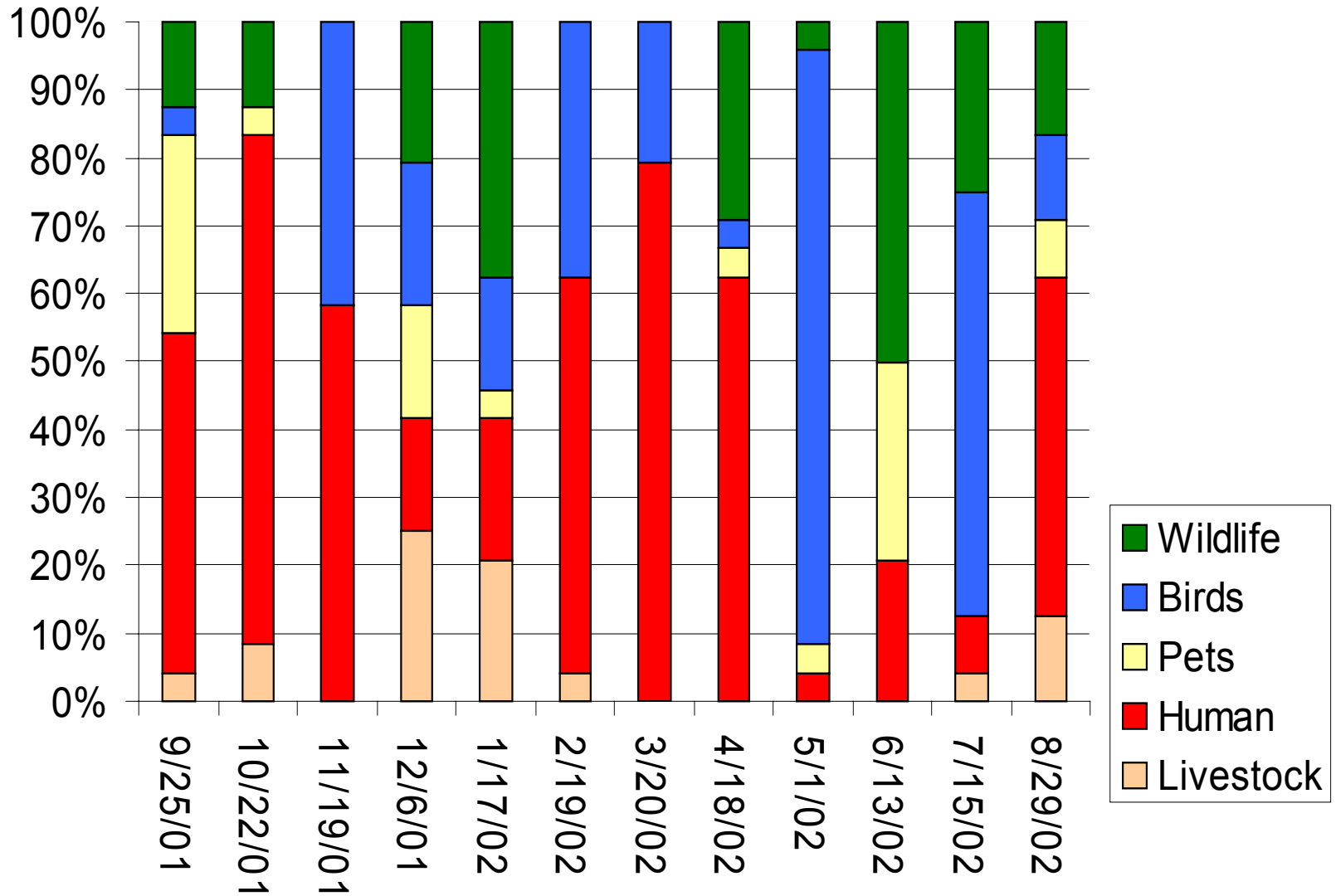


# Little Wicomico River Station 19

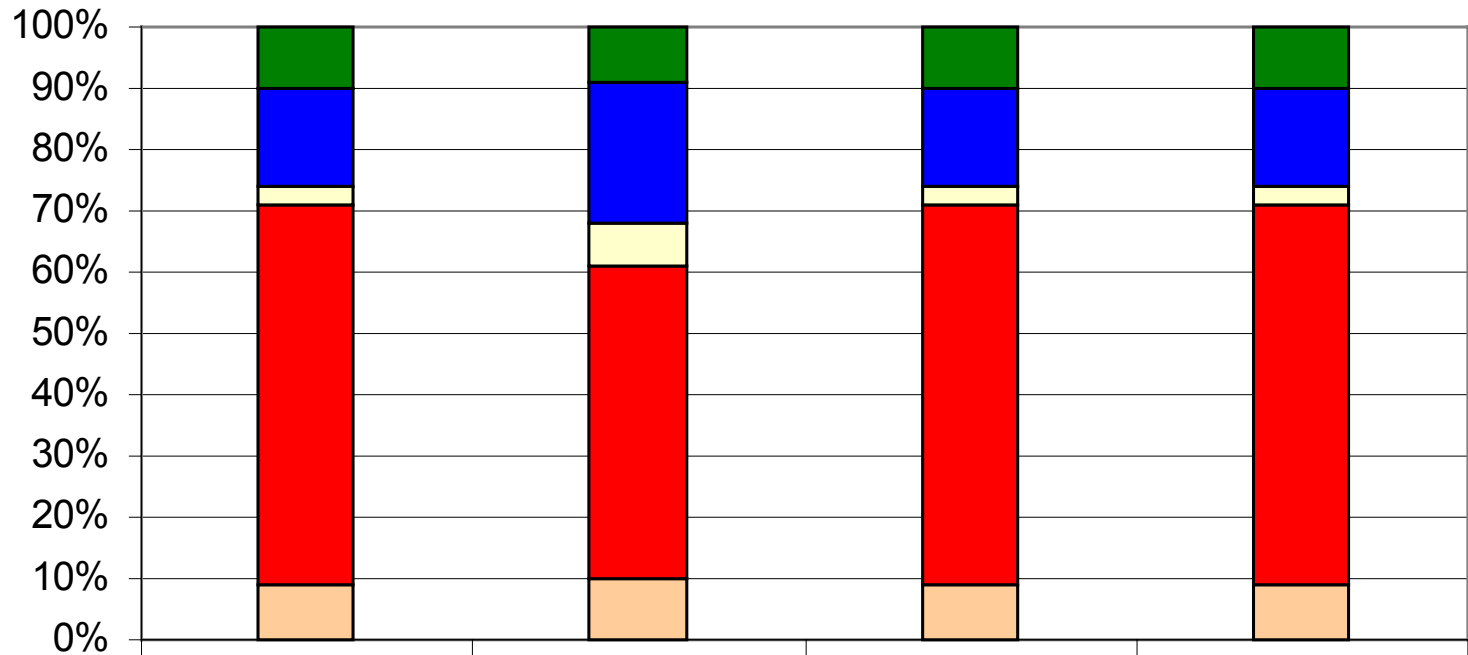




## Little Wicomico River Station 20



# Average BST for the Little Wicomico River



	9x	13.5z	19	20
Wildlife	10	9	10	10
Birds	16	23	16	16
Pets	3	7	3	3
Human	62	51	62	62
Livestock	9	10	9	9



## Geometric Mean Load Calculation Results for the Little Wicomico River

CLOSURE ID AND STATION NUMBER	GEO –METRIC MEAN	SEGMENT VOLUME (CUBIC METERS)	VOLUME X GEO - MEAN	VOLUME X CRITERIA (14MPN/100M L)	(ALLOW- ABLE LOAD )– (EXISTING LOAD)	REQUIRED REDUCTION IN PERCENT
180 STATION 9X	7.6	175,387.31	1.34E+10	2.46E+10	1.12E+10	NA
180-A STATION 13.5Z	7.7	152,369.11	1.17E+10	2.13E+10	-9.59E+9	NA
180 – B STATION 19	26.3	395,208.17	1.04E+11	5.53E+10	.86E+10	87.8%
180 – B STATION 20	17.3	Using same volume as STA 19	6.85E+10	5.53E+10	1.32E+10	23.8%

# Load Calculation Result 90th Percentile

## for the Little Wicomico River

CLOSURE ID AND STATION NUMBER	90 <sup>TH</sup> PERCENT. VALUE (MPN/100ML)	SEGMENT VOLUME (CUBIC METERS)	VOLUME X 90 <sup>TH</sup> PERCENT. VALUE = ACTUAL LOAD	VOLUME X 90 <sup>TH</sup> CRITERIA (49MPN/100ML ) = LOAD ALLOCATION	(ALLOW-ABLE LOAD )– (EXISTING LOAD) = LOAD REDUCTION	REQUIRED LOAD REDUCTION IN PERCENT
180 STATION 9X	45	175,387.31	7.89E+10	8.59E+10	-7.02E+9	NA
180 –A STATION 13.5Z	58	152,369.11	8.84E+10	7.47E+10	1.37E+10	18.4%
180 – B STATION 19	64.9	395,208.17	2.56E+11	1.94E+11	6.28E+10	32.4%
180 – B STATION 20	76.8	Using same volume as STA 19	3.04E+11	1.94E+11	1.10E+11	56.7%



# TMDL Little Wicomico River Stations 9x and 13.5z

<b>AREA 180 STATION 9X</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>7.89E+10</b>	<b>8.59E+10</b>	<b>NA</b>
<b>Bird</b>	<b>16%</b>	<b>1.26E+10</b>	<b>1.26E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>10%</b>	<b>7.89E+09</b>	<b>7.89E+09</b>	<b>0%</b>
<b>Human</b>	<b>62%</b>	<b>4.89E+10</b>	<b>4.89E+10</b>	<b>0%</b>
<b>Pets</b>	<b>3%</b>	<b>2.37E+09</b>	<b>2.37E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>9%</b>	<b>7.10E+09</b>	<b>7.10E+09</b>	<b>0%</b>

<b>AREA 180-A STATION 13.5Z</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>8.84E+10</b>	<b>7.47E+10</b>	<b>18%</b>
<b>Bird</b>	<b>23%</b>	<b>2.03E+10</b>	<b>2.03E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>9%</b>	<b>7.96E+09</b>	<b>7.96E+09</b>	<b>0%</b>
<b>Human</b>	<b>51%</b>	<b>4.51E+10</b>	<b>3.14E+10</b>	<b>30%</b>
<b>Pets</b>	<b>7%</b>	<b>6.19E+09</b>	<b>6.19E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>10%</b>	<b>8.84E+09</b>	<b>8.84E+09</b>	<b>0%</b>



# TMDL Little Wicomico River Stations 19 and 20

<b>AREA 180 – B STATION 19</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>2.56E+11</b>	<b>1.94E+11</b>	<b>32%</b>
<b>Bird</b>	<b>16%</b>	<b>4.10E+10</b>	<b>4.10E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>10%</b>	<b>2.56E+10</b>	<b>2.56E+10</b>	<b>0%</b>
<b>Human</b>	<b>62%</b>	<b>1.59E+11</b>	<b>9.95E+10</b>	<b>37%</b>
<b>Pets</b>	<b>3%</b>	<b>7.68E+09</b>	<b>7.68E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>9%</b>	<b>2.05E+10</b>	<b>2.05E+10</b>	<b>0%</b>

<b>AREA 180 - B STATION 20</b>	<b>BST Result % of total load</b>	<b>Actual Load (cfu)*</b>	<b>Load Allocation (cfu)*</b>	<b>Reduction needed</b>
<b>Total</b>	<b>100%</b>	<b>3.04E+11</b>	<b>1.94E+11</b>	<b>57%</b>
<b>Bird</b>	<b>16%</b>	<b>4.86E+10</b>	<b>4.86E+10</b>	<b>0%</b>
<b>Wildlife</b>	<b>10%</b>	<b>3.04E+10</b>	<b>3.04E+10</b>	<b>0%</b>
<b>Human</b>	<b>62%</b>	<b>1.88E+11</b>	<b>8.20E+10</b>	<b>56%</b>
<b>Pets</b>	<b>3%</b>	<b>9.12E+09</b>	<b>9.12E+09</b>	<b>0%</b>
<b>Livestock</b>	<b>9%</b>	<b>2.43E+10</b>	<b>2.43E+10</b>	<b>0%</b>

## INITIAL CONCLUSIONS FOR TMDL

- \* Major pollutant load appears to be of human origin**
- \* Data shows little or no seasonal effect**
- \* Wildlife and birds are not indicated as principal contributors to pollutant loading**
- \* Human loads are required to be reduced at the 100% level, therefore significant results may be expected through reductions in this contributor.**



## *Staged Implementation*

- TMDLs typically include staged reduction targets
  - allows most cost-effective measures to be implemented first
  - allows iterative evaluation of TMDL adequacy in achieving water quality standard



## *Next Steps*

- TMDL Development
  - field work is complete
  - BST analysis is complete
  - draft TMDL (in progress)
- Implementation Plan
- Implementation
- Thoughts or Comments



# *Discussion Topics*

- Comments on method
  - Source Identification
  - TMDL Calculation
- Suggestions for Public Process
  - Timing
  - Content
  - Notification (who, how)